WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
	E907	**$209,356**	**$342,050**	**$952,800**	**$1,930,273**	**$1,849,590**	**$328,333**	**$1,601,940**
1	Experiment Design	$0	$0	$0	$0	$0	$0	$0
	Develop experiment Monte Carlo code. Optimize detector geometry and placement. Evaluate implementation trade-offs. Estimate Source: Physicist Estimate Basis: 4 physicists @ 0.25% during the installation year.							
2	**Meson Detector Building (MDB**	**$1,760**	**$28,464**	**$100,000**	**$157,574**	**$157,574**	**$0**	**$157,574**
	Plan and execute in MC5 and MC6 (Meson Center) of the Meson Hall (a) the removal of existing equipment, shielding, etc.; (b) any necessary refurbishments of these areas; and (c) the installation of necessary infrastructure (electrical power, cooling water, controls, safety systems, etc.) for the subsequent installation and operation of E907.							
2.1	MDB Preparation Planning	$1,760	$0	$0	$2,270	$2,270	$0	$2,270
	Plan all work required to prepare MC5 and MC6 for installation of E907 upstream beam line components. This item includes (a) work plans and ES&H preparation for opening the Pretarget Enclosure and Target Pile in MC6; (b) work plans for removing interfering beam line technical components from MC5 and MC6; (b) work plans for any necessary refurbishments of these areas; and (c) any engineering pre-design and work plans required for the installation of necessary infrastructure (electrical power, cooling water, controls, safety systems, etc.) for the subsequent installation and operation of Upstream Beam Line technical components. Estimate Source: Physicist Estimate Basis: 1 Mechanical Engineer @ 100%							
2.2	MC6 Clear Storage from Top of P	$0	$15,180	$0	$20,820	$20,820	$0	$20,820
	Remove all stored material from the top of the MC6 Pretarget Enclosure and Target Pile, in preparation for opening same. Estimate Source: Tech. Supervisor Estimate Basis: Eyeball estimate of duration required to remove all the material stored as of April 2000. 5 person rigging crew @ 100% 1 Tech Specialist FNAL - TM 1 Senior Tech FNAL - TM 3 Technician FNAL - TM							
2.3	**Open and Clear Pretarget Encl**	**$0**	**$11,576**	**$50,000**	**$73,964**	**$73,964**	**$0**	**$73,964**
	Open the Pretarget Enclosure (PTE) in MC6 and remove interfering beam line technical components, including items in the MC5 enclosure. This item includes: (a) removal of the concrete and steel lid sections of the Pretarget Enclosure; (b) removal of the steel sidewall shielding inside the enclosure, to allow the E907 horizontal offset in that area; (c) removal of all interfering beam line technical components from the MC5 enclosure and the exposed section of the MC6 enclosure. (It is possible that some components or shielding may remain without interfering with the subsequent installation of E907 beamline technical components; this will be determined by the "MC6 Cleanout Planning" element.)							
2.3.1	PTE Remove Concrete Lid Blocks	$0	$0	$37,500	$43,650	$43,650	$0	$43,650
	Removal of the concrete lid sections of the PTE in MC6. Estimate Source: Scaling, Tech. Supervisor, Physicist Estimate Basis: Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves removing approximately five times as much shielding, hence the 3 week duration. This work can be performed by contract riggers. 5 T&M Riggers @ 100%							
2.3.2	PTE Remove Steel Lid	$0	$0	$12,500	$14,550	$14,550	$0	$14,550
	Removal of the steel lid sections of the PTE in MC6. Estimate Source: Scaling, Tech. Supervisor, Physicist Estimate Basis: Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves removing approximately twice as much shielding so we use the same duration. This work can be performed by contract riggers. 5 T&M Riggers @ 100%							
2.3.3	PTE Remove Steel Side Walls	$0	$5,060	$0	$6,940	$6,940	$0	$6,940
	Removal of the steel side wall sections of the PTE in MC6. It is likely that only the eastern wall will be removed to accomadate the displacement of the E907 beam to the east in this region. Estimate Source: Scaling, Tech. Supervisor, Physicist Estimate Basis: Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves removing approximately twice as much shielding so we use the same duration.							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"PTE Remove Steel Side Walls" continued								
	5 person rigging crew @ 100% 1 Tech Specialist FNAL - TM 1 Senior Tech FNAL - TM 3 Technician FNAL - TM							
2.3.4	PTE Disconnect Magnets	$0	$3,480	$0	$4,660	$4,660	$0	$4,660
	Disconnect water and power from all magnets in the PTE region of MC6 and all interfering devices in MC5. Estimate Source: Tech Supervisor, Physicist Estimate Basis: MC6 presently contains four 10' dipoles and one 20' dipole that must be removed, as well as numerous other small components. We assume that the seven quadrupoles and two trim dipoles in MC5 can remain. For this estimate we assume two technicians can disconnect one magnet per day, and allow an equal amount of time for other components. 2 Technician - FNAL @ 100%							
2.3.5	PTE Remove Magnets	$0	$3,036	$0	$4,164	$4,164	$0	$4,164
	Remove interfering beam line technical components from MC5 and the PTE section of MC6. Estimate Source: Tech Supervisor, Physicist Estimate Basis: We assume that a five person rigging crew can move two magnets per day, and allow half a day of startup/cleanup. 5 person rigging crew @ 100% 1 Tech Specialist FNAL - TM 1 Senior Tech FNAL - TM 3 Technician FNAL - TM							
2.4	**Open and Clear Target Pile (TP**	**$0**	**$1,708**	**$50,000**	**$60,520**	**$60,520**	**$0**	**$60,520**
	Open the Target Pile (TP) in MC6 and remove the MC6SWP magnet and decay pipe. This item is restricted to removing the lids without disturbing the sidewalls, in order to minimize the disturbance of dispersable radioactive material.							
2.4.1	TP Remove Concrete Lid Blocks	$0	$0	$25,000	$29,100	$29,100	$0	$29,100
	Removal of the concrete lid sections of the TP in MC6. Estimate Source: Scaling, Tech. Supervisor, Physicist Estimate Basis: Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace This item involves removing approximately twice as much shielding, hence the 2 week duration. This work can be performed by contract riggers. 5 T&M Riggers @ 100%							
2.4.2	TP Remove Steel Plugs	$0	$0	$12,500	$14,550	$14,550	$0	$14,550
	Removal of the steel lid sections of the TP in MC6. Estimate Source: Scaling, Tech. Supervisor, Physicist Estimate Basis: Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves removing approximately twice the amount of shielding so we use the same duration. This work can be performed by contract riggers. 5 T&M Riggers @ 100%							
2.4.3	TP Remove Downstream Concret	$0	$0	$12,500	$14,550	$14,550	$0	$14,550
	Removal of the downstream TP concrete shielding blocks in MC6. Estimate Source: Scaling, Tech. Supervisor, Physicist Estimate Basis: Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves removing approximately twice the amount of shielding so we use the same duration. This work can be performed by contract riggers. 5 T&M Riggers @ 100%							
2.4.4	TP Disconnect Magnet	$0	$696	$0	$932	$932	$0	$932
	Disconnect water and power from MC6SWP magnet in the MC6 TP. Estimate Source: Tech Supervisor, Physicist Estimate Basis: We assume two technicians need one day for this task. 2 Technician - FNAL @ 100%							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
2.4.5	TP Remove Magnet	$0	$1,012	$0	$1,388	$1,388	$0	$1,388

Remove MC6SWP magnet from MC6 TP.

Estimate Source: Tech Supervisor, Physicist

Estimate Basis:
We assume that a five person rigging crew needs one day for this item, including startup/cleanup.

5 person rigging crew @ 100%
1 Tech Specialist FNAL - TM
1 Senior Tech FNAL - TM
3 Technician FNAL - TM

3	**E907 Beamline (BEAM) in MC6**	**$14,080**	**$21,450**	**$100,000**	**$163,895**	**$163,895**	**$0**	**$163,895**

Design and install in MC5 and MC6 (Meson Center) of the Meson Hall beam line technical components for the E907 secondary beam, excluding beam detectors. This item includes
(a) focussing and steering magnets to target the beam on the secondary beam production target;
(b) the E907 momentum selection bend;
(c) the E907 secondary beam production target; and
(c) focussing and steering magnets to target the secondary beam on the experimental target.
This item does not include beam line instrumentation.

3.1	BEAM Optics and Mechanical De	$14,080	$0	$0	$18,160	$18,160	$0	$18,160

Design the optics and installation of the Meson Hall beam line technical components for the E907 secondary beam, excluding beam detectors.

Estimate Source: Physicist

Estimate Basis:
We assume a physicist will need two weeks at 100% to refine the optics design, and will support the engineers at 0.25%. We assum a mechanical and electrical engineer will need four weeks at 100% to design the installation.

1 Physicist @ 50%
1 Engineer - Mechanical @ 50%
1 Engineer - Electrical @ 50%

3.2	**BEAM Magnet Installation**	**$0**	**$12,200**	**$0**	**$16,620**	**$16,620**	**$0**	**$16,620**

Install in MC5 and MC6 beam line technical components for the E907 secondary beam, excluding beam detectors. This item includes
(a) focussing and steering magnets to target the beam on the secondary beam production target;
(b) the E907 momentum selection bend;
(c) the E907 secondary beam production target; and
(c) focussing and steering magnets to target the secondary beam on the experimental target.
We assume that the seven quadrupoles and two trim dipoles in MC5 will be adequate in their current locations. This item does not include beam line instrumentation.

3.2.1	BEAM Install 3 Dipoles	$0	$6,180	$0	$8,430	$8,430	$0	$8,430

Install in MC5 and MC6 three large dipoles to provide the momentum selection bump. This item provides mounting of the dipoles, as well as power, cooling water, and interlock connections.

Estimate Source: Tech Supervisor, Physicist

Estimate Basis:
We assume two Senior Techs need one week per magnet to make all connections. We assume that power cables will be run from the power supply room at the west side of the Meson Hall, and that the water supply to MC6 will be increased by installing new headers from the building LCW system. The water system will also provide LCW to the quadrupoles.

2 Senior Techs @ 100%

3.2.2	BEAM Install 4 Quadrupoles	$0	$4,120	$0	$5,620	$5,620	$0	$5,620

Install in MC5 and MC6 seven quadrupoles to provide the momentum selection and experimental target focussing. This item provides mounting of the quadrupoles, as well as power, cooling water, and interlock connections.

Estimate Source: Tech Supervisor, Physicist

Estimate Basis:
We assume two Senior Techs need one day per magnet to make all connections. We assume that power cables will be run from the power supply room at the west side of the Meson Hall, and that the dipole LCW water installation will provide the necessary cooling water.

2 Senior Techs @ 100%

3.2.3	BEAM Survey	$0	$1,900	$0	$2,570	$2,570	$0	$2,570

Survey all beam line technical components for the E907 secondary beam, including beam detectors.

Estimate Source: Physicist

Estimate Basis:
We assume a team consisting of one physicist, one Senior Tech, and one Technician need one week to survey all components in MC5 and MC6.

1 Physicst @ 100%
1 Senior Tech @ 100%
1 Technician @ 100%

3.3	**Close Pretarget Enclosure**	**$0**	**$9,250**	**$50,000**	**$70,915**	**$70,915**	**$0**	**$70,915**

Replace steel and concrete shielding in the MC6 Pretarget Enclosure.

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
3.3.1	PTE Replace Steel Side Walls	$0	$5,060	$0	$6,940	$6,940	$0	$6,940

Replacement of the steel side wall sections of the PTE in MC6.

Estimate Source: Scaling, Tech. Supervisor, Physicisist

Estimate Basis:
Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves replacing approximately twice as much shielding so we use the same duration.

5 person rigging crew @ 100%
1 Tech Specialist FNAL - TM
1 Senior Tech FNAL - TM
3 Technician FNAL - TM

3.3.2	PTE Remove T-Block Lower Stee	$0	$4,190	$0	$5,775	$5,775	$0	$5,775

Unweld the lower pieces of steel on the so-called "T-block" assemblies to accommodate the secondary beam elevation.

This is a scope change from the November 2000 baseline plan, caused by raising the beam elevation to accommodate the MC7 slab over MBottom.

Estimate Source:

Estimate Source: Scaling, Physicisist

Estimate Basis:
We estimate one week of rigging and two weeks of technicians (welders).

5 person rigging crew @ 100%
1 Tech Specialist FNAL - TM
1 Senior Tech FNAL - TM
3 Technician FNAL - TM

2 Technician FNAL - TM @ 100%

3.3.3	PTE Replace Steel Lid	$0	$0	$12,500	$14,550	$14,550	$0	$14,550

Replacement of the steel lid sections of the PTE in MC6.

Estimate Source: Scaling, Tech. Supervisor, Physicist

Estimate Basis:
Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves replacing approximately twice as much shielding so we use the same duration. This work can be performed by contract riggers.

5 T&M Riggers @ 100%

3.3.4	PTE Replace Concrete Lid Blocks	$0	$0	$37,500	$43,650	$43,650	$0	$43,650

Replacement of the concrete lid sections of the PTE in MC6.

Estimate Source: Scaling, Tech. Supervisor, Physicist

Estimate Basis:
Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves replacing approximately five times as much shielding, hence the 3 week duration. This work can be performed by contract riggers.

5 T&M Riggers @ 100%

3.4	**Close Target Pile**	**$0**	**$0**	**$50,000**	**$58,200**	**$58,200**	**$0**	**$58,200**

Replace steel and concrete shielding in the MC6 Target Pile.

3.4.1	TP Replace Downstream Concret	$0	$0	$12,500	$14,550	$14,550	$0	$14,550

Replacement of the downstream TP concrete shielding blocks in MC6.

Estimate Source: Scaling, Tech. Supervisor, Physicist

Estimate Basis:
Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves replacing approximately twice the amount of shielding so we use the same duration. This work can be performed by contract riggers.

5 T&M Riggers @ 100%

3.4.2	TP Replace Steel Plugs	$0	$0	$12,500	$14,550	$14,550	$0	$14,550

Replacement of the steel lid sections of the TP in MC6.

Estimate Source: Scaling, Tech. Supervisor, Physicist

Estimate Basis:
Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace. This item involves replacing approximately twice the amount of shielding so we use the same duration. This work can be performed by contract riggers.

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"TP Replace Steel Plugs" continued								
	5 T&M Riggers @ 100%							
3.4.3	TP Replace Concrete Lid Blocks	$0	$0	$25,000	$29,100	$29,100	$0	$29,100
	Replacement of the concrete lid sections of the TP in MC6. Estimate Source: Scaling, Tech. Supervisor, Physicist Estimate Basis: Scaled from the 1998 access to the Hyper-CP MC6SWP magnet in the upstream section of the MC6 Target Pile, which required a five person T&M rigging crew one week to remove and replace This item involves replacing approximately twice as much shielding, hence the 2 week duration. This work can be performed by contract riggers. 5 T&M Riggers @ 100%							
4	**Meson Worm (MC7) Preparatio**	**$27,660**	**$48,654**	**$235,500**	**$398,158**	**$346,388**	**$182,278**	**$215,880**
	Removal of the HyperCP detectors and magnets from the MC7 Worm. This item includes opening and closing the MC7 roof at the location of the BM109 magnets to permit crane access.							
4.1	**Remove or Stage HyperCP Det**	**$0**	**$6,460**	**$12,500**	**$33,870**	**$23,288**	**$33,870**	**$0**
	Removal of the Hyper-CP detectors from the MC7 worm.							
4.1.1	MC7 Remove 9 PWC	$0	$3,800	$0	$13,750	$5,140	$13,750	$0
	Removal of the 9 wire chambers from the MC7 worm. This item includes disconnecting all services, dismounting the chambers, and removing them from the worm for storage. Estimate Source: Physicist Estimate Basis: We assume two technicians need one day per chamber to disconnect, dismount, remove, and store it. 1 Senior Tech @ 100% 1 Technician @ 100%							
4.1.2	MC7 Remove Muon Arms	$0	$1,900	$12,500	$20,120	$17,120	$20,120	$0
	Removal of the two muon/calorimeter arms from the MC7 worm. This item includes disconnecting all services, dismounting the detectors and removing them from the worm for storage, and removal of sampling steel and support blocks. Estimate Source: Physicist Estimate Basis: We assume two technicians need one week to disconnect, dismount, remove, and store the detectors. We a five person rigging crew will need one week to remove the heavy components through the downstream door, which was their entry route. 1 Senior Tech @ 50% 1 Technician @ 50% 5 T&M Riggers @ 50%							
4.1.3	MC7 Remove 2 HODO	$0	$760	$0	$0	$1,028	$0	$0
	Removal of two hodoscopes from the MC7 worm. Estimate Source: Physicist Estimate Basis: We assume two technicians need two days to disconnect, dismount, remove, and store it. 1 Senior Tech @ 100% 1 Technician @ 100%							
4.2	**Remove BM109 Magnets**	**$0**	**$5,526**	**$22,500**	**$38,390**	**$33,667**	**$38,390**	**$0**
	Remove the BM109 magnets from the upstream bump out of the MC7 worm. This item includes disconnecting the magnets from services, moving utilities to enable opening the roof, prepping the exterior area for use by a mobile crane, and rigging out the magnet pieces.							
4.2.1	MC7 Disconnect BM109 Magnets	$0	$1,030	$0	$2,995	$1,405	$2,995	$0
	Disconnect electrical and water services for the BM109 magnets in MC7. Estimate Source: Physicist Estimate Basis: We assume a technician needs a week to disconnect the services. 1 Senior Tech @ 100%							
4.2.2	MC7 Prep Outside Area for Crane	$0	$2,770	$0	$6,595	$3,735	$6,595	$0
	Prepare exterior area on east side of MC7 worm for mobile crane access. This item removes a fence and other light equipment in the alley between the MC7 and MP7 worms. Estimate Source: Tech Supervisor Estimate Basis: We assume a technician crew of three needs one week to prepare the area. 1 Senior Tech @ 100%							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"MC7 Prep Outside Area for Crane" continued								
	2 Technicians @ 100%							
4.2.3	MC7 Remove Utilities	$0	$1,030	$0	$11,995	$1,405	$11,995	$0
	Remove utilities from the east wall of the MC7 worm in the area of the upstream bumpout. This is necessary to enable gantry crane access from the east alley.							
	Estimate Source: Senior Tech, Physicist							
	Estimate Basis: We assume a technician needs one week.							
	1 Senior Tech @ 100%							
4.2.4	MC7 Open Worm US	$0	$696	$0	$0	$932	$0	$0
	Remove MC7 worm roof and east wall at the upstream bumpout.							
	Estimate Source: Scaling, Senior Tech							
	Estimate Basis: Scaled from the access to the MC9 worm to extract shielding steel. We assume two technicians need two days.							
	2 Technician @ 100%							
4.2.5	MC7 Rig Out BM109 Magnets	$0	$0	$22,500	$16,805	$26,190	$16,805	$0
	Erect gantry crane and rig out two BM109 magnets to east alley. Rent mobile crane to move pieces from gantry to truck.							
	Estimate Source: Scaling, Senior Tech							
	Estimate Basis: Scaled from 1999 removal of Jolly Green Giant magnet from Lab G, which took a T&M rigging crew four weeks at a cost of $40,000. This item is approximately one fourth in size, and we have escalated the rate. We also include rental of a mobile truck crane, since the highest capacity FNAL truck crane is likely to be inadequate.							
	5 T&M Rigger @ 100% 1 Crane Rental @ 100%							
4.3	**Close MC7 Worm US**	**$0**	**$7,120**	**$9,000**	**$14,210**	**$20,036**	**$7,220**	**$6,990**
	Close the MC7 upstream worm roof and east wall at the upstream bump out.							
4.3.1	MC7 US Replace Panels and Inst	$0	$1,900	$9,000	$7,220	$13,046	$7,220	$0
	Replace roof and east wall of MC7 at the upstream bump out.							
	Estimate Source: Scaling, Senior Tech							
	Estimate Basis: Scaled from the vendor cost to replace the MC8 roof after removing steel blocks. Scaling by the number and type of panels, we estimate one week for two technicians and $9,000 in M&S.							
	1 Senior Tech @ 100% 1 Technician @ 100% $9,000 M&S							
4.3.2	MC7 US Restore Utilities	$0	$5,220	$0	$6,990	$6,990	$0	$6,990
	Restore utilities to the east wall of the MC7 worm in the area of the upstream bumpout.							
	Estimate Source: Senior Tech, Physicist							
	Estimate Basis: We assume two technicians need one week.							
	2 Technicians @ 100%							
4.4	**MBottom Shoring**	**$27,660**	**$24,720**	**$18,000**	**$102,798**	**$60,507**	**$102,798**	**$0**
	Design, fabricate, and install shoring in MBottom to support the analysis magnets, JGG and Rosie.							
	This is a scope increase over the November 2000 baseline plan, caused by moving the experiment downstream to accommodate longer beam Cherenkov counters.							
4.4.1	MB Shoring Engineering & Desigr	$27,660	$0	$0	$27,660	$13,620	$27,660	$0
	Design thel shoring required in MBottom to support the analysis magnets, JGG and Rosie. This task includes obtaining FESS approval for the design.							
	Estimate Source: physicist, engineer							
	Estimate Basis: We assume this task requires an engineer for 6 weeks.							
	1 Mechanical Engineer @ 100%							
4.4.2	MB Shoring Fabrication	$0	$9,270	$4,000	$21,006	$15,141	$21,006	$0
	Fabricate the shoring beams and footings for MBottom.							
	Estimate Source: Tech. Supervisor							
	Estimate Basis: We assume this task requires three technicians three weeks.							
	3 Technicians @ 100%							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"MB Shoring Fabrication" continued								
	$4K M&S							
4.4.3	MB Shoring Installation	$0	$15,450	$1,000	$38,900	$16,614	$38,900	$0
	Install the MBottom shoring. Estimate Source: Tech. Supervisor Estimate Basis: We assume this task requires 5 technicians 3 weeks, and $1K in supplies. 5 Technicians @ 100% $1K M&S							
4.4.4	MC Slab	$0	$0	$13,000	$15,232	$15,132	$15,232	$0
	Install MC7 slab to spread floor load of the analyzing magnets, JGG and Rosie. Estimate Source: Tech. Supervisor Estimate Basis: Vendor Quote $13K M&S							
4.5	**MC7 DS Roof**	**$0**	**$4,828**	**$83,500**	**$104,130**	**$104,130**	**$0**	**$104,130**
4.5.1	MC7 Temporary Wall	$0	$0	$1,500	$1,746	$1,746	$0	$1,746
	Remove the MC7 roof downstream of the middle bumpout. This is a scope increase over the November 2000 baseline plan, caused by moving the experiment downstream to accommodate longer beam Cherenkov counters, which required us to add a slab to spread the floor load of the magnets, which raises the beam height. Estimate Source: Tech. Supervisor Estimate Basis: Tech Supervisor $1500 M&S							
4.5.2	MC7 Remove DS Roof	$0	$1,988	$0	$2,856	$2,856	$0	$2,856
	Replace the MC7 roof downstream of the middle bumpout. This is a scope increase over the November 2000 baseline plan, caused by moving the experiment downstream to accommodate longer beam Cherenkov counters, which required us to add a slab to spread the floor load of the magnets, which raises the beam height. Estimate Source: Tech. Supervisor Estimate Basis: We estimate one Tech Specialiest for 7 days. 1 Technician @ 100%							
4.5.3	MC7 Replace DS Roof	$0	$2,840	$82,000	$99,528	$99,528	$0	$99,528
	Replace the MC7 roof downstream of the middle bumpout. This is a scope increase over the November 2000 baseline plan, caused by moving the experiment downstream to accommodate longer beam Cherenkov counters, which required us to add a slab to spread the floor load of the magnets, which raises the beam height. Estimate Source: Tech. Supervisor Estimate Basis: Vendor Quote, Tech Supervisor The vendor quotes: $40K materials, $30K installation, $12K insulation. In addition, we estimate that a technician needs to support the vendor for two weeks. 1 Technician @ 100% $82K M&S							
4.6	MC7 Magnet Primary Power	$0	$0	$90,000	$104,760	$104,760	$0	$104,760
	Install primary power for analyzing magnet power supplies. There are four options that have been developed for sourcing the AC power and sitnig the DC supplies. See the note by Leon Beverly for details. We assume the middle cost options which locate the supplies in MC7. Estimate Source: Tech. Supervisor Estimate Basis: We assume that the supplies will be located in MC8. The estimate is $90K of trades labor (largely electrician). $70K M&S							
5	**E907 Experiment (in MC7)**	**$165,856**	**$243,482**	**$517,300**	**$1,124,594**	**$1,095,681**	**$146,055**	**$978,539**
	Design, fabricate, install, and make operational all beam line and detector components of E907.							
5.1	MC7 Design	$13,536	$0	$0	$13,070	$18,060	$1,140	$11,930

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
5.2	**Upstream Beamline Detectors (**	**$7,040**	**$26,780**	**$0**	**$45,610**	**$45,610**	**$0**	**$45,610**
	Design, refurbish or fabricate, install, and make operational all beam line detectors upstream of the Experimental Target station (ETGT). These components include: (a) wire chambers, beam definition scintillators, flags, and current monitors; and (b) Cerenkov detectors to tag the secondary beam particles.							
5.2.1	UBL Design	$7,040	$0	$0	$9,080	$9,080	$0	$9,080
	Design and installation plan for all beam line detectors upstream of the Experimental Target station (ETGT). Estimate Source: Physicist Estimate Basis: We assume one physicist for a week to design the instrumentation layout. We assume two engineers, one electrical and one mechanical, for two weeks to design the detector mounting and services, supervised by additional week of the physicist. 1 Physicist @ 50% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 50%							
5.2.2	UBL Secondary Production Targe	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Build the E907 secondary beam production target and insertion device. Estimate Source: Physicist Estimate Basis: We assume two technicians need four weeks to build the target. 2 Technician @ 100%							
5.2.3	UBL Tracking Chamber Refurbish	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Refurbish beam wire chambers. Estimate Source: Physicist Estimate Basis: We assume one technician needs four weeks. 1 Technician @ 100%							
5.2.4	UBL Cerenkov (BCKV) Fabricatio	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Build two beam tagging Cerenkov chambers. Estimate Source: Physicist Estimate Basis: We assume two technicians need four weeks. 2 Technicians @ 100%							
5.2.5	**UBL Installation**	**$0**	**$6,180**	**$0**	**$8,430**	**$8,430**	**$0**	**$8,430**
	Install beam line detectors in the MC5 and MC6 enclosures.							
5.2.5.1	UBL Pretarget Enclosure Detecto	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Install upstream beam detectors in the MC5 and MC6 enclosures. Estimate Source: Physicist Estimate Basis: We assume one physicist and two technicians need four weeks. 1 Physicist @ 100% 2 Technician @ 100%							
5.2.5.2	UBL Target Pile Detectors Installa	$0	$2,060	$0	$2,810	$2,810	$0	$2,810
	Install upstream beam detectors in the MC6 target pile. Estimate Source: Physicist Estimate Basis: We assume one physicist and one technician need two weeks. 1 Physicist @ 100% 2 Technician @ 100%							
5.3	**Jolly Green Giant (JGG)**	**$15,200**	**$5,655**	**$111,000**	**$154,177**	**$115,783**	**$106,809**	**$47,368**
	Move from its present location, assess the condition of, refurbish as required, install, and make operational all components of the FNAL E690 Jolly Green Giant magnet (JGG). These include (a) disassembly and removal from its current location, (b) construction or repair of a coil to replace one that is shorted, (c) design, fabrication, and installation of a support structure in MC, (d) assembly in MC, (e) field mapping to the extent deemed necessary (bearing in mind that FNAL E690 has already developed high precision maps), (e) necessary support systems, including power supplies, cooling water, and protection system.							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
5.3.1	JGG Move & Installation Design	$9,920	$0	$0	$11,930	$9,080	$1,425	$10,505

Design of the installation of the JGG.

Estimate Source: Physicist

Estimate Basis:
We assume one physicist week, two electrical engineer weeks, and two mechanical engineer weeks.

1 Physicist @ 25%
1 Engineer - Electrical @ 50%
1 Engineer - Mechanical @ 50%

5.3.2	JGG Replacement Coil	$5,280	$0	$86,000	$105,384	$69,840	$105,384	$0

Repair of the JGG shorted coil, or purchase of a replacement.

Estimate Source: Budgetary Quote, Physicist

Estimate Basis:
Pacific Electric Motor provided a budgetary quote in 1991 of $55,000 to build a replacement coil. Escalation due to inflation since that time is ~30%, while the price of copper has decreased by ~30%. We assume $60,000 M&S for a new coil.

$60,000 M&S

5.3.3	JGG Assembly	$0	$1,420	$25,000	$31,140	$31,140	$0	$31,140

Assembly of the JGG in the MC7 worm.

Estimate Source: Scaling, Senior Tech, Physicist

Estimate Basis:
Scaled from 1999 removal of Jolly Green Giant and TPL M2 magnets from Lab G, which took a T&M rigging crew four weeks at a cost of $40,000. We estimate a three person T&M rigging crew for one week, one week rental for a 90T crane, and one week of a FNAL Senior Tech.

5 T&M Riggers @ 100%
1 Senior Tech - FNAL @ 100%
1 Rental 120T Crane @ 100%

5.3.4	JGG Connections	$0	$4,235	$0	$5,723	$5,723	$0	$5,723

Power, LCW, and interlock connections to the JGG

Estimate Source: Senior Tech, Physicist

Estimate Basis:
We estimate three technicians a week for the power and LCW, and a technician for half a week for interlocks.

1 Senior Tech @ 100%
2.5 Technicians @ 100%

5.4	**Rosie Magnet (Rosie)**	**$9,920**	**$5,371**	**$14,000**	**$35,581**	**$32,731**	**$1,425**	**$34,156**

Move from its present location, assess the condition of, refurbish as required, install, and make operational all components of the Rosie magnet. These include
(a) disassembly and removal from its current location,
(b) construction or repair of a coil to replace one that is shorted,
(c) design, fabrication, and installation of a support structure in MC,
(d) assembly in MC,
(e) field mapping to the extent deemed necessary (bearing in mind that FNAL E690 has already developed high precision maps),
(e) necessary support systems, including power supplies, cooling water, and protection system.

5.4.1	Rosie Move & Installation Design	$9,920	$0	$0	$11,930	$9,080	$1,425	$10,505

Design of the installation of the Rosie magnet, or equivalent.

Estimate Source: Physicist

Estimate Basis:
We assume one physicist week, two electrical engineer weeks, and two mechanical engineer weeks.

1 Physicist @ 25%
1 Engineer - Electrical @ 50%
1 Engineer - Mechanical @ 50%

5.4.2	Rosie Assembly	$0	$1,136	$14,000	$17,928	$17,928	$0	$17,928

Assembly of the Rosie magnet in the MC7 worm.

Estimate Source: Scaling, Senior Tech, Physicist

Estimate Basis:
Scaled from 1999 removal of Jolly Green Giant and TPL M2 magnets from Lab G, which took a T&M rigging crew four weeks at a cost of $40,000. We estimate a three person T&M rigging crew for five days, a 90T crane rental, and one week of a FNAL Senior Tech

5 T&M Riggers @ 100%
1 Senior Tech - FNAL @ 100%
1 Rental 90T Crane @ 100%

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
5.4.3	Rosie Connections	$0	$4,235	$0	$5,723	$5,723	$0	$5,723
	Power, LCW, and interlock connections to the Rosie magnet....							
5.5	**Differential Cerenkov (CKOV)**	**$14,080**	**$29,400**	**$25,000**	**$84,546**	**$87,223**	**$7,692**	**$76,854**
	Move from its present location, assess the condition of, refurbish as required, install, and make operational all components of the FNAL E766/FNAL E690/BNL E910 differential Cernkov counter (CKOV).							
5.5.1	CKOV Move	$0	$7,692	$0	$7,692	$10,369	$7,692	$0
	Dismantle, package for shipping, and ship the CKOV from BNL to FNAL. Estimate Source: Senior Tech, Physicist Estimate Basis: We assume two technicians for one week, plus their travel expenses from LLNL to BNL, plus material. 2 Technicians @ 100% $2,300 M&S							
5.5.2	CKOV Chamber Move & Installati	$1,760	$0	$0	$2,270	$2,270	$0	$2,270
	Design the installation of the CKOV. Estimate Source: Physicist Estimate Basis: We assume one physicist week, two electrical engineer weeks, and two mechanical engineer weeks. 1 Physicist @ 25% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 50%							
5.5.3	CKOV Equipment Installation Des	$5,280	$0	$0	$6,810	$6,810	$0	$6,810
	Design the installation of the CKOV. Estimate Source: Physicist Estimate Basis: We assume one physicist week, two electrical engineer weeks, and two mechanical engineer weeks. 1 Physicist @ 25% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 50%							
5.5.4	CKOV Undercarriage Fabrication	$3,520	$8,240	$10,000	$27,420	$27,420	$0	$27,420
	Fabrication of the CKOV support hardware. Estimate Source: Physicist Estimate Basis: We assume two technicians for four weeks, a mechanical engineer for two weeks, and $10,000 M&S. 2 Technician @ 100% 1 Engineer - Mechanical @ 50% $10,000 M&S							
5.5.5	CKOV Freon Recovery Fabricatio	$3,520	$8,240	$10,000	$27,420	$27,420	$0	$27,420
	Fabrication of the CKOV freon circulation and recovery system. Estimate Source: Physicist Estimate Basis: We assume two technicians for four weeks, a mechanical engineer for two weeks, and $10,000 M&S. 2 Technician @ 100% 1 Engineer - Mechanical @ 50% $10,000 M&S							
5.5.6	CKOV Locate in Position	$0	$1,108	$0	$1,494	$1,494	$0	$1,494
	Installation of the CKOV in the MC7 worm. Estimate Source: Experience, Physicist Estimate Basis: Three physicists completely disassembled and packed the CKOV components in two days in August 2000. We assume four technicians and a physicist need two days to install and reassemble the CKOV. 1 Physicist @ 100% 1 Senior Tech @ 100% 3 Technician @ 100%							
5.5.7	CKOV Align Mirrors	$0	$0	$0	$0	$0	$0	$0

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
5.5.8	CKOV Connections	$0	$4,120	$5,000	$11,440	$11,440	$0	$11,440
	Install gas, high voltage, and signal cabling to the CKOV. Estimate Source: Physicist Estimate Basis: We assume two technicians need two weeks, and $5,000 M&S. 2 Technicians @ 100% $5,000 M&S							
5.6	Magnets & CKOV in MC7	$0	$0	$0	$0	$0	$0	$0
5.7	**Experimental Targets (ETGT)**	**$12,320**	**$20,600**	**$0**	**$43,990**	**$43,990**	**$0**	**$43,990**
	Design, refurbish or fabricate, install, and make operational all components for the experimental target station (ETGT) just upstream of the TPC in MC7, including (a) (possibly multiple) target wheels (TGTW) for thin homogeneous targets, (b) thick homogeneous targets and mounting, (c) cryogenic targets and mounting, and (d) NuMI Target samples (nTGT).							
5.7.1	**Target Wheel (TGTW)**	**$1,760**	**$3,090**	**$0**	**$6,485**	**$6,485**	**$0**	**$6,485**
	Design, refurbish or fabricate, install, and make operational (possibly multiple) target wheels (TGTW) for thin homogeneous targets.							
5.7.1.1	TGTW Design	$1,760	$0	$0	$2,270	$2,270	$0	$2,270
	Design of the (possibly multiple) target wheels (TGTW) for thin homogeneous targets. Estimate Source: Physicist Estimate Basis: We assume one physicist week to design the targets, and half of two engineers, one mechanical and one electrical, to design the mounting, installation, control, and interlocks. 1 Physicist @ 100% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 50%							
5.7.1.2	TGTW Fabrication	$0	$2,060	$0	$2,810	$2,810	$0	$2,810
	Fabrication of (possibly multiple) target wheels. Estimate Source: Physicist Estimate Basis: We assume one technician needs two weeks to fabricate the target wheel system and targets. 1 Technician @ 100%							
5.7.1.3	TGTW Installation	$0	$1,030	$0	$1,405	$1,405	$0	$1,405
	Installation of the target wheel system. Estimate Source: Physicist Estimate Basis: We assume one technician needs one week to install the target wheel system and targets. 1 Technician @ 100%							
5.7.2	**Cryogenic Target (CTGT)**	**$7,040**	**$12,360**	**$0**	**$25,940**	**$25,940**	**$0**	**$25,940**
	Design, refurbish or fabricate, install, and make operational the cryogenic hydrogen and nitrogen target systems.							
5.7.2.1	CTGT Design	$7,040	$0	$0	$9,080	$9,080	$0	$9,080
	Design of the cryogenic hydrogen and nitrogen target systems. Estimate Source: Physicist Estimate Basis: We assume tw0 physicist week to design the targets, and four mechanical engineer weeks. 1 Physicist @ 50% 1 Engineer - Mechanical @ 100%							
5.7.2.2	CTGT Fabrication	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Fabrication of the cryogenic hydrogen and nitrogen target systems. Estimate Source: Physicist Estimate Basis: We assume two technicians need fourweeks to fabricate the cryogenic hydrogen and nitrogen target systems. 2 Technician @ 100%							
5.7.2.3	CTGT Installation	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Installation of the cryogenic hydrogen and nitrogen target systems. Estimate Source: Physicist							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"CTGT Installation" continued								
	Estimate Basis: We assume two technicians need two weeks to install the cryogenic hydrogen and nitrogen target systems. 2 Technician @ 100%							
5.7.3	**NuMI Target Sample (NTGT)**	**$3,520**	**$5,150**	**$0**	**$11,565**	**$11,565**	**$0**	**$11,565**
	Design, fabrication, and installation of the NuMI target assembly and mounting.							
5.7.3.1	NTGT Design	$3,520	$0	$0	$4,540	$4,540	$0	$4,540
	Design of the NuMI target assembly and mounting. Estimate Source: Physicist Estimate Basis: We assume one physicist week and two mechanical engineer weeks. 1 Physicist @ 50% 1 Engineer - Mechanical @ 100%							
5.7.3.2	NTGT Fabrication	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Fabrication of the NuMI target assembly and mounting. Estimate Source: Physicist Estimate Basis: We assume that the target itself can be obtained from NuMI as a prototype. Since our beam current is low, this will not be a destructive test of the target, and leave it only mildly radioactive. We assume that one technician will need four weeks to fabricate the mounting fixtures. 1 Technician @ 100%							
5.7.3.3	NTGT Installation	$0	$1,030	$0	$1,405	$1,405	$0	$1,405
	Installation of the NuMI target assembly and mounting. Estimate Source: Physicist Estimate Basis: We assume one technician will need one week to install the NuMI target assembly. 1 Technician @ 100%							
5.8	**Target Recoil Detector (TRD)**	**$28,160**	**$24,720**	**$0**	**$70,040**	**$70,040**	**$0**	**$70,040**
	Design, refurbish or fabricate, install, and make operational all components for the Target Recoil Detector (TRD).							
5.8.1	TRD Design	$28,160	$0	$0	$36,320	$36,320	$0	$36,320
	Design of the TRD. Estimate Source: Physicist Estimate Basis: We assume one physicist and two engineers, one mechanical and one electrical, for two months. 1 Physicist @ 100% 1 Engineer - Electrical @ 100% 1 Engineer - Mechanical @ 100%							
5.8.2	TRD Fabrication	$0	$12,360	$0	$16,860	$16,860	$0	$16,860
	Fabrication of the TRD. Estimate Source: Physicist Estimate Basis: We assume one physicist and three technicians for fourweeks. 1 Physicist @ 100% 3 Technician @ 100%							
5.8.3	TRD Installation	$0	$12,360	$0	$16,860	$16,860	$0	$16,860
	Installation of the TRD. Estimate Source: Physicist Estimate Basis: We assume one physicist and three technicians for fourweeks. 1 Physicist @ 100% 3 Technician @ 100%							
5.9	**Time Projection Chamber (TPC**	**$10,560**	**$15,932**	**$22,300**	**$56,492**	**$61,152**	**$19,992**	**$36,500**
	Assess the condition of, refurbish as required, install, and make operational all components of the LBNL EOS/BNL E895/BNL E910 time projection chamber (TPC). This includes (a) assessing the condition of the chamber and refurbishing as necessary,							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"Time Projection Chamber (TPC)" continued								
	(b) physical mounting and support, (c) high voltage system, (d) gas handling system, and (e) chamber readout up to the data acquisition (DAQ) interface.							
5.9.1	**TPC Move to FNAL**	**$0**	**$7,692**	**$12,300**	**$19,992**	**$19,992**	**$19,992**	**$0**
	Prepare for shipment, package, and ship the TPC from BNL to FNAL.							
5.9.1.1	TPC Move Shipping Container	$0	$7,692	$2,300	$9,992	$9,992	$9,992	$0
	Design and fabricate the TPC shipping container. Estimate Source: Senior Tech, Physicist Estimate Basis: We assume two technicians for one week, plus their travel expenses from LLNL to BNL, plus material. 2 Technicians @ 100% $2,300 M&S							
5.9.1.2	TPC Move Transportation	$0	$0	$10,000	$10,000	$10,000	$10,000	$0
	Package and ship the TPC from BNL to FNAL. Estimate Source: Vendor Quote, Physicist Estimate Basis: Vendor quote for shipping the TPC crate, seven double wide electronic racks, and two crates of cables. $10,000 M&S							
5.9.2	TPC Assess Condition	$0	$0	$0	$0	$0	$0	$0
	Assess the condition of the TPC at FNAL after shipping. This item includes: (a) installation of the cathode plane; (b) measurement of the field cage current at 10 kV nominal operating voltage; (c) measurement of the anode currents at 1300 V nominal operating voltage. Estimate Source: Physicist Estimate Basis: Based Gulshan Rai's estimate, we assume four physicists and one technician for one week. 4 Physicist @ 100% 1 Technician @ 100%							
5.9.3	**TPC Test in Mtest**	**$0**	**$0**	**$0**	**$0**	**$4,660**	**$0**	**$0**
	Install and test the TPC in MTest This is a scope increase since the November 2000 baseline.							
5.9.3.1	TPC MTest Installation	$0	$0	$0	$0	$4,660	$0	$0
	Install the TPC and all support systems in MTest for testing with cosmic rays. Estimate Source: Physicist Estimate Basis: We estimate this will take a physicist 4 days per month, and a technician 1 week per month. 16 days Physicist 4 weeks Technician							
5.9.3.2	TPC Mtest Testing	$0	$0	$0	$0	$0	$0	$0
5.9.4	TPC Installation Design	$10,560	$0	$0	$13,620	$13,620	$0	$13,620
	Design of the TPC installation, including mechanical, gas system, and high voltage, low voltage, slow control, and fiber optic cabling. Estimate Source: Physicist Estimate Basis: We assume one physicist week, two electrical engineer weeks, and four mechanical engineer weeks. 1 Physicist @ 25% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 100%							
5.9.5	TPC Installation	$0	$8,240	$10,000	$22,880	$22,880	$0	$22,880
	Installation of the TPC chamber, gas rack, power supplies, and cabling. Estimate Source: Physicist Estimate Basis: We assume one physicist and two technicians for four weeks, plus $10,000 in material. 1 Physicist @ 100% 2 Technicians @ 100% $10,000 M&S							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
5.10	**Time-of-Flight (TOF)**	**$10,560**	**$24,720**	**$125,000**	**$192,840**	**$192,840**	**$0**	**$192,840**
	Locate a suitable existing parts, move them from their present location, assess the condition of, refurbish or replace as required, install, and make operational all components of the time-of-flight (TOF). This item includes (a) the scintillator pieces, (b) the photo-multiplier tubes (PMTs) and bases, (c) the assembly of scintillator and PMTs into working detector modules, (e) the mechanical support system, (d) the high voltage system, and (e) the electronics up to the interface with the data acquisition system (DAQ).							
5.10.1	TOF Design	$10,560	$4,120	$0	$19,240	$19,240	$0	$19,240
	Design of the TOF system installation, test existing scintillator and phototubes for use in system. Design electrical readout and high voltage as well as mechanical support structure of the TOF wall. Estimate Source: Physicist Estimate Basis: We assume twelve physicist weeks, two electrical engineer weeks, and four mechanical engineer weeks, and four technician weeks. 3 Physicist @ 100% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 100% 1 Technician @ 100%							
5.10.2	TOF Fabrication	$0	$8,240	$100,000	$127,640	$127,640	$0	$127,640
	Fabrication of the TOF installation components, purchase of new components not available at Fermilab as needed. Wrapping of scintillator, attaching. PMTs, light leak testing Estimate Source: Physicist Estimate Basis: We assume two physicisst and two technicians for fourweeks. 2 Physicist @ 100% 2 Technician @ 100% $100K M&S							
5.10.3	TOF Installation	$0	$12,360	$25,000	$45,960	$45,960	$0	$45,960
	Installation of the TOF components and construction of mounting structure. Install and verify cabling to phototubes and readout electronics. Estimate Source: Physicist Estimate Basis: We assume two technicians for six weeks and one physicist for six weeks. 1 Physicist @ 100% 2 Technician @ 100% $25K M&S							
5.11	**Ring Imaging Cerenkov (RICH)**	**$16,320**	**$23,354**	**$120,000**	**$184,203**	**$184,207**	**$8,996**	**$175,207**
	Move from its present location, assess the condition of, refurbish as required, install, and make operational all components of the FNAL SELEX (E781) ring imaging Cerenkov counter (RICH). These include (a) disassembly and removal from its current location, (b) design, fabrication, and installation of a support structure in MC, (c) assembly in MC, (d) modifications to the gas handling system to accomadate the E907 gas selection, (e) replacement of photo-multiplier tubes, as necessary, (f) the high voltage system, and (g) the electronics up to the interface to the data acquisition system (DAQ).							
5.11.1	RICH Installation Design	$16,320	$0	$0	$14,780	$9,080	$3,420	$11,360
	Design the installation of the RICH. Estimate Source: Physicist Estimate Basis: We assume one physicist week, two electrical engineer weeks, and two mechanical engineer weeks. 1 Physicist @ 25% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 50%							
5.11.2	**RICH Extraction from PC4**	**$0**	**$5,576**	**$0**	**$5,576**	**$11,280**	**$5,576**	**$0**
	Move the RICH from PC4 to MC7. We assume that fabricating a new tank will be cheaper than extracting the existing tank from PC4.							
5.11.2.1	RICH Remove PMTs	$0	$0	$0	$0	$4,660	$0	$0
	Remove and package the RICH phototubes and bases. Estimate Source: Physicist Estimate Basis: We assume two technicians for two weeks, supervised by a physicist for 2 days total. 1 Physicist @ 25% 2 Technicians @ 100%							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
5.11.2.2	RICH Open End Flanges	$0	$1,456	$0	$1,456	$1,960	$1,456	$0
	Remove upstream and downstream window flanges from the RICH. Estimate Source: Physicist Estimate Basis: We assume four technicians need one per flange. 1 Senior Tech @ 100% 3 Technicians @ 100%							
5.11.2.3	RICH Remove Mirrors	$0	$2,060	$0	$2,060	$2,330	$2,060	$0
	Remove the mirrors from the RICH. Estimate Source: Physicist Estimate Basis: We assume two technicians need one week to remove the mirrors, supervised by a physicist for one day. 1 Physicist @ 25% 2 Technicians @ 100%							
5.11.2.4	RICH Disconnect Support Equipn	$0	$2,060	$0	$2,060	$2,330	$2,060	$0
	Disconnect power supplies and gas system from the RICH. Estimate Source: Physicist Estimate Basis: We assume two technicians need one week, supervised by a physicist for one day. 1 Physicist @ 25% 2 Technicians @ 100%							
5.11.3	RICH Position Tank in MC7	$0	$728	$0	$980	$980	$0	$980
	Position RICH tank in MC7. Estimate Source: Senior Tech, Physicist Estimate Basis: We assume four technicians can locate the tank in MC7 in one day. 1 Senior Tech @ 100% 3 Technicians @ 100%							
5.11.4	RICH Install Mirrors	$0	$1,998	$0	$2,681	$2,681	$0	$2,681
	Install the RICH mirrors into the RICH in MC7. Estimate Source: Physicist Estimate Basis: We assume that two technicians need one week to install the mirrors, supervised by a physicist and a Senior Tech. 1 Physicist @ 50% 1 Senior Tech @ 25% 2 Technicians @ 100%							
5.11.5	RICH Close End Flanges	$0	$1,662	$0	$2,241	$2,241	$0	$2,241
	Install the window flanges at each end of the RICH tank. Estimate Source: Senior Tech, Physicist Estimate Basis: We assume a crew of four technicians need one day for each flange. 1 Senior Tech @ 100% 3 Technicians @ 100%							
5.11.6	RICH Install Support Equipment	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Install RICH support equipment. Estimate Source: Physicist Estimate Basis: We assume two technicians need two weeks, supervised by a physicist. 1 Physicist @ 25% 2 Technicians @ 100%							
5.11.7	RICH Gas Clean & FIll	$0	$1,030	$0	$1,405	$1,405	$0	$1,405
	Purge the RICH and fill with gas. Estimate Source: Experience, Physicist Estimate Basis: We assume two technicians need one week, supervised by a physicist.							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"RICH Gas Clean & FIll" continued								
	1 Physicist @ 25% 2 Technicians @ 100%							
5.11.8	RICH Purchase PMTs	$0	$0	$60,000	$69,840	$69,840	$0	$69,840
	Purchase the RICH PMTs from the Russian owners. Estimate Source: Vendor Quote Estimate Basis: The Russian group has agreed to sell the PMTs for $60,000. $60,000 M&S							
5.11.9	RICH Install PMTs	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Install the RICH phototubes and bases. Estimate Source: Physicist Estimate Basis: We assume two technicians for two weeks, and a physicist for one week. 1 Physicist @ 50% 2 Technicians @ 100%							
5.11.10	RICH Front End Electronics	$0	$0	$60,000	$69,840	$69,840	$0	$69,840
5.11.11	RICH Install Electronics	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Install the RICH electronics. Estimate Source: Physicist Estimate Basis: We assume two technicians and a physicist for two weeks. 1 Physicist @ 100% 2 Technicians @ 100%							
5.12	**Drift Chambers (DC)**	**$5,280**	**$31,930**	**$100,000**	**$166,765**	**$166,765**	**$0**	**$166,765**
	Install, and make operational all components of the drift chamber system (DC). These may be refurbished as-yet unidentified existing chambers, new chambers of the FNAL E690 design but somewhat larger, or refurbished E690 chambers. This item includes (a) the chambers, (b) their support structures, (c) the gas handling system, (d) the high voltage system, and (e) the electronics up to the interface with the data acquisition system (DAQ).							
5.12.1	DC Move & Installation Design	$5,280	$3,090	$0	$11,025	$11,025	$0	$11,025
	Design of the DC installation. Estimate Source: Physicist Estimate Basis: We assume a physicist at quarter time, three electrical engineer weeks, and three mechanical engineer weeks. 1 Physicist @ 25% 1 Engineer - Electrical @ 50% 1 Engineer - Mechanical @ 50%							
5.12.2	DC Move	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Move the DCs to MC7. Estimate Source: Physicist Estimate Basis: We assume two technicians for a month. 2 Technicians @ 100%							
5.12.3	DC Parts Fabrication	$0	$12,360	$100,000	$133,260	$133,260	$0	$133,260
	Fabrication of the DC installation parts. Estimate Source: Physicist Estimate Basis: We assume two technicians for six weeks, plus $100,000 M&S 2 Technician @ 100% $100,000 M&S							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
5.12.4	DC Installation	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Installation of the DCs. Estimate Source: Physicist Estimate Basis: We assume two technicians for four weeks. 2 Technician @ 100%							
5.13	**Neutral Calorimeter (NCAL)**	**$8,800**	**$16,480**	**$0**	**$33,830**	**$33,830**	**$0**	**$33,830**
	Design, refurbish or fabricate, install, and make operational all components for the Neutral Calorimeter (NCAL).							
5.13.1	NCAL Design	$8,800	$0	$0	$11,350	$11,350	$0	$11,350
	Design of the NCAL installation. Estimate Source: Physicist Estimate Basis: We assume a physicist and mechanical engineer for a month, and one electrical engineer week. 1 Physicist @ 100% 1 Engineer - Mechanical @ 100% 1 Engineer - Electrical @ 25%							
5.13.2	NCAL Fabrication	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Fabrication of the NCAL installation hardware. Estimate Source: Physicist Estimate Basis: We assume two technicians for four weeks. 2 Technician @ 100%							
5.13.3	NCAL Installation	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Installation of the NCAL. Estimate Source: Physicist Estimate Basis: We assume two technicians for four weeks. 2 Technician @ 100%							
5.14	**Trigger (TRG)**	**$7,040**	**$6,180**	**$0**	**$17,510**	**$17,510**	**$0**	**$17,510**
	Design, construct, and install the trigger system (TRG). This item includes (a) specialized trigger detectors, their electronics, and support systems, (b) collection of all trigger signals from the various sources, (c) computation of a variety of trigger conditions, (d) prescaling of those conditions, (e) selection of appropriate triggers, and (f) the distribution of trigger signals to the data acquisition and all detector systems.							
5.14.1	TRG Design	$7,040	$0	$0	$9,080	$9,080	$0	$9,080
	Design of the trigger (TRG). Estimate Source: Physicist Estimate Basis: We assume a physicist and electrical engineer for a month. 1 Physicist @ 100% 1 Engineer - Electrical @ 100%							
5.14.2	TRG Fabrication	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Fabrication of the trigger (TRG). Estimate Source: Physicist Estimate Basis: We assume a physicist and technician for a month. 1 Physicist @ 100% 1 Technician @ 100%							
5.14.3	TRG Installation	$0	$2,060	$0	$2,810	$2,810	$0	$2,810
	Installation of the trigger (TRG). Estimate Source: Physicist Estimate Basis: We assume a physicist and technician for two weeks.							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"TRG Installation" continued								
	1 Physicist @ 100% 1 Technician @ 100%							
5.15	**Data Acquisition (DAQ)**	**$7,040**	**$12,360**	**$0**	**$25,940**	**$25,940**	**$0**	**$25,940**
	Design, construct, and install the data acquisition system (DAQ). This item includes (a) all electronics from a defined interface with each detector system up to the digitizers, (b) collection of all digitized signals, (c) on-line processing, (d) performance monitoring, and (d) permanent storage of all data.							
5.15.1	DAQ Design	$7,040	$0	$0	$9,080	$9,080	$0	$9,080
	Design of the Data Acquisition (DAQ). Estimate Source: Physicist Estimate Basis: We assume a physicist and electrical engineer for a month. 1 Physicist @ 100% 1 Engineer - Electrical @ 100%							
5.15.2	DAQ Fabrication	$0	$8,240	$0	$11,240	$11,240	$0	$11,240
	Fabrication of the DAQ. Estimate Source: Physicist Estimate Basis: We assume two physicists and a technician for two months. 2 Physicist @ 100% 1 Technician @ 100%							
5.15.3	DAQ Installation	$0	$4,120	$0	$5,620	$5,620	$0	$5,620
	Installation of the DAQ. Estimate Source: Physicist Estimate Basis: We assume a physicist and technician for a month. 1 Physicist @ 100% 1 Technician @ 100%							
6	**Data Taking (DATA)**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Plan and execute the run plan for acquiring engineering, calibration, and beam data.							
6.1	DATA Engineering Run	$0	$0	$0	$0	$0	$0	$0
	Operation of the experiment for a two week engineering run. Estimate Source: Physicist Estimate Basis: We assume operations are manned 24/7 in three shifts, with four people per shift. We also assume four crews with one day off every four. 16 Physicist @ 100%							
6.2	DATA 1% Targets	$0	$0	$0	$0	$0	$0	$0
	Operation of the experiment for a four month run using the target wheel and cryogenic targets. Estimate Source: Physicist Estimate Basis: We assume operations are manned 24/7 in three shifts, with four people per shift. We also assume four crews with one day off every four. 16 Physicist @ 100%							
6.3	DATA Cryo Target	$0	$0	$0	$0	$0	$0	$0
6.4	DATA NuMI Target Running	$0	$0	$0	$0	$0	$0	$0
	Operation of the experiment for a two week run with the NuMI target. Estimate Source: Physicist Estimate Basis: We assume operations are manned 24/7 in three shifts, with four people per shift. We also assume four crews with one day off every four. 16 Physicist @ 100%							
6.5	Data Collection Complete	$0	$0	$0	$0	$0	$0	$0

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
7	**Core Analysis**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Process all data to (a) assess and correct for the effects of detector and system calibrations, (b) compute 4-vectors for all tracks, (c) determine resolution functions, and (d) quantify systematic errors.							
7.1	**Analysis Development**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Development of subsystem analysis packages.							
7.1.1	UBL Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of UBL analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.2	TRD Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of TRD analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.3	TPC Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of TPC analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs four months to develop the code. 1 Physicist @ 100%							
7.1.4	JGG Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of JGG analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.5	CKOV Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of CKOV analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.6	TOF Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of TOF analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.7	TPL-B Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of TPL-B analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.8	RICH Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of RICH analysis package. Estimate Source: Physicist							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"RICH Analysis Development" continued								
	Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.9	DC Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of DC analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.10	NCAL Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of NCAL analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.1.11	TRG/DAQ Analysis Development	$0	$0	$0	$0	$0	$0	$0
	Development of TRG/DAQ analysis package. Estimate Source: Physicist Estimate Basis: We assume one physicist needs two months to develop the code. 1 Physicist @ 100%							
7.2	**Tracking & PID Integration**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Integration of subsystem analysis packages to enable track matching, global fitting, and particle ID.							
7.2.1	UBL-TGT-TRD-TPC Tracking	$0	$0	$0	$0	$0	$0	$0
	Development of UBL-TGT-TRD-TPC integrated analysis. Estimate Source: Physicist Estimate Basis: We assume two physicists need one month to develop the code. 2 Physicist @ 100%							
7.2.2	TPC-CKOV Tracking & PID	$0	$0	$0	$0	$0	$0	$0
	Development of TPC-CKOV integrated analysis. Estimate Source: Physicist Estimate Basis: We assume two physicists need one month to develop the code. 2 Physicist @ 100%							
7.2.3	CKOV-TOF Tracking & PID	$0	$0	$0	$0	$0	$0	$0
	Development of CKOV-TOF integrated analysis. Estimate Source: Physicist Estimate Basis: We assume two physicists need one month to develop the code. 2 Physicist @ 100%							
7.2.4	TOF-RICH Tracking & PID	$0	$0	$0	$0	$0	$0	$0
	Development of TOF-RICH integrated analysis. Estimate Source: Physicist Estimate Basis: We assume two physicists need one month to develop the code. 2 Physicist @ 100%							
7.2.5	RICH-NCAL Tracking	$0	$0	$0	$0	$0	$0	$0
	Development of RICH-NCAL integrated analysis. Estimate Source: Physicist							

WBS	Task Name	EDIA	Labor	M&S	Total Cost	Baseline	To Date	Remaining
"RICH-NCAL Tracking" continued								
	Estimate Basis: We assume two physicists need one month to develop the code. 2 Physicist @ 100%							
7.3	Core Analysis Production	$0	$0	$0	$0	$0	$0	$0
	Production analysis pass through all data, producing four vector momenta and particle ID for all tracks. Estimate Source: Physicist Estimate Basis: We assume one physicist will need two months to pass all data through the core analysis. 1 Physicist @ 100%							
8	Project Management	$0	$0	$0	$86,052	$86,052	$0	$86,052
	Project management for the construction of E907. Estimate Source: Physicist Estimate Basis: We assume one physicist will need one week per month to track the project development during the construction year. 1 Physicist @ 25%							